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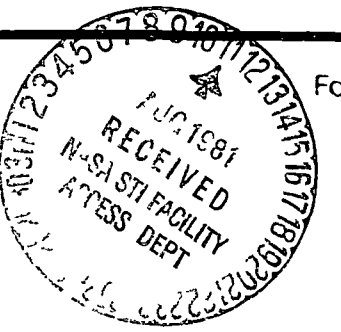

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FIRST REUSABLE SPACESHIP PREPARED FOR SECOND MISSION

The Orbiter Columbia, the world's first reusable spaceship, is scheduled to move out of its hangar at Kennedy Space Center, Fla , no earlier than Aug 4, a milestone in preparations for the second launch of the Space Shuttle, now scheduled for no earlier than Sept 30

The Orbiter, which performed almost flawlessly on its maiden voyage, will be towed from the Orbiter Processing Facility to the Vehicle Assembly Building for mating to its external tank and twin solid rocket boosters

Columbia arrived at the Kennedy Space Center's Shuttle Landing Facility on April 28, 1981, exactly two weeks after its pinpoint landing on Roger's Dry Lake at Edwards AFB, Calif , at the completion of its historic first trip into space

Columbia was returned to the spaceport on the back of a modified 747 jumbo jet from NASA's Dryden Flight Research Center at Edwards

Preparations began immediately to remove the 98-ton spaceship off the top of its carrier aircraft The following morning, it was towed from the Landing Facility to the Orbiter Processing Facility The vehicle was powered up and preparations started for removing the twin Orbital Maneuvering System pods and the Forward Reaction Control System

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Once Columbia was in the processing facility, engineers spent about two weeks troubleshooting any minor problems recorded by Astronauts John Young and Robert Crippen during their successful 54-hour mission -- such as the failed Waste Management System and the faulty heater bed on Auxiliary Power Unit No 2 Both the Waste Management System and power unit were replaced while Columbia was in the processing facility

On May 7, the left hand Orbital Maneuvering System pod was removed and transported to the Hypergolic Maintenance Facility in Kennedy's Industrial Area. The right-hand pod and Forward Reaction Control System were removed the following day.

The Shuttle's powerful three main engines were thoroughly inspected inside and out The engines were left on the Orbiter for the inspection, however, the high pressure fuel pumps on each engine were removed and closely examined for any sign of problems as a result of the flight

No problems were found and the turbopumps were reinstalled Leak and functional checks were made first of each individual engine, followed by checks of the entire Main Propulsion System

A total of 264 tiles were removed from the two pods, 129 on the right pod and 135 on the left pod Some 36 square feet of the felt reusable surface insulation had to be taken off each pod so the graphite-epoxy skin underneath could be repaired About 6 square feet of the reusable insulation on each pod was replaced with tiles -- 25 on each pod Other work performed on the orbiter's engine pods included replacement of relief valves on the fuel and oxidizer systems.

Five struts which support the forward reaction control system propellant tanks were replaced During the post-flight inspection of the system, one strut was found partially crumpled due to the unexpectedly high overpressure created by the powerful boosters at liftoff. Other struts located in the Orbiter's base heat shield were replaced with new, strengthened ones as a result of the overpressure problem

Modifications were also made at Launch Complex 39's Pad A to reduce the amount of overpressure created by the boosters. These changes consisted of rerouting water lines which dump thousands of gallons of water on the surface of the Shuttle's transportable launch base prior to ignition

Regulators for the system which provide the pressurizing medium -- gaseous helium -- to the orbital maneuvering and reaction control systems propellant tanks were removed and replaced in both pods and the Forward Reaction Control System One right hand thruster was replaced on the Forward Reaction Control System and a new fuel probe was installed in the right hand maneuvering system fuel tank The maneuvering system engine nozzle on the left hand pod was also replaced.

On May 11, the Mobile Launcher Platform was moved into the Vehicle Assembly Building's High Bay 3 Some structural beef up work was done on the transportable launch base as a result of minimal damage to the platform from the first Shuttle launch

Most of that work was performed on the eight holddown posts which support and restrain the Shuttle before liftoff New ablative material was applied to the holddown posts

The Orbiter was powered down May 12 so modifications could begin to prepare the reusable spaceship for its second mission Many of the modifications were made in the payload bay to support power and cooling requirements of the OSTA-1 experiments package, the first payload to be carried into orbit by the Shuttle.

The faulty Auxiliary Power Unit No. 2 was removed and replaced with a new unit. The Power Reactant Storage and Distribution System storage tanks which supply supercold liquid oxygen and liquid hydrogen to the fuel cells, and the three electricity-producing fuel cells, were also removed and replaced.

A number of avionics boxes in the Orbiter were replaced. Most of these were part of either the Orbiter's instrumentation system, used to send commands to other Shuttle components, or to the electrical power distribution and control system which takes electricity from the fuel cells and distributes it to various Orbiter systems Many of these boxes were sent back to Rockwell's Downey, Calif facility for inspection to learn more about their performance during the Shuttle's first mission.

The Development Flight Instrumentation pallet, which recorded the effects of launch, orbit and reentry on the Orbiter during its first flight, was moved to a location further back in the Orbiter's cargo bay to make room for the OSTA-1 payload.

Assembly of the STS-2 solid rocket boosters on the Mobile Launcher Platform started on May 20 with the stacking of the two aft assemblies Stacking of the 45-meter (150-foot) tall boosters was completed on June 2 when the two forward assemblies were added to the twin booster rockets

Engineers reported the Orbiter's thermal protection system withstood the rigors of the first launch extremely well Most of the damage incurred during the first mission is thought to have occurred during ascent from a combination of frost, ice and thermal insulation debris from the external tank A detailed inspection of the Orbiter's tiles revealed about 350 tiles that would have to be removed and replaced with new tiles Another 818 would be removed for densification and about 2,000 tiles would be repaired in place

The ablative material around the Orbiter's elevons was removed and replaced with new ablative material. The elevons are the only areas where ablative material is used for thermal insulation.

Tiles on the body flap caught the brunt of the heat loads from the first Shuttle launch For STS-1, a bonding agent was placed in the gaps between neighboring tiles on some regions of the body flap as a temporary, one-flight only, thermal barrier

Some of the bonding agent that was exposed to the extreme temperatures of reentry boiled out between the sides of the tiles. The bonding agent eroded the edges of about 36 tiles on the sides of the body flap These tiles were repaired by routing out the eroded edges and filling the cleaned out area with a mixture of small tile chips. These gaps will be filled with permanent, multi-mission gap fillers on subsequent flights to avoid this type of repair between missions

All three landing gear were inspected Only the wheels on the two main landing gear were replaced

On June 9, the Orbiter was powered up for the first time since the start of the power-down modification period Checks were first made of the main electrical buses that supply power to the vehicle, followed by extensive checks of each of the Orbiter's systems including: interior and exterior lights, caution and warning system, Orbiter communications system, Space Shuttle Main Engine electrical interfaces, hydraulic system, navigation aids, purge, vent and drain system, flight controls and aerodynamic surfaces, environmental control and life support system, active thermal control system, fuel cells and power reactant storage and distribution system

Also, leak and functional checks were performed of the Main Propulsion System and Auxiliary Power Units The twin Mass Memory Units were checked by loading the units with flight programs, then dumping the data for comparison against desired data for discrepancies

The Inertial Measurement Units, a critical part of the Orbiter's navigation system, were calibrated and functionally checked A review of data gathered during the mission revealed a 1 hour 10 minute period when cooling air to unit No 3 stopped, allowing some of the sensitive components inside to overheat This unit was subsequently replaced and retested

The external tank arrived at Kennedy on April 22 It was brought by barge from the Michoud Assembly Facility, New Orleans and was offloaded at the Turn Basin at Complex 39 It was transported to the Vehicle Assembly Building and hoisted into the checkout cell in High Bay 4 for checkout and application of insulation around various areas of the tank.

Range Safety System antennas, batteries and ordnance were installed. Both the external tank liquid hydrogen and liquid oxygen tanks were pressurized and leak tested The external tank was powered up for the first time May 11 so that vent valves could be tested and checks started of the various instrumentation systems onboard

Technicians performed an entry into the liquid oxygen tank June 3 to replace some bolts connected to the external tank's tumble valve system On June 15, workers started removing seven instrumentation islands.

Cables were also installed and cable covers put in place while the tank was in its checkout cell Following the liquid oxygen entry task, the liquid oxygen pressure transducers were retested, followed by an all-systems test of the tank which began June 12.

A new nose cone was installed June 22 on the tank The new nose cone had a modified gaseous oxygen diffuser, part of a modification to the tank that is expected to remedy a problem with the gaseous oxygen vent arm "beanie cap" which did not work properly for the STS-1 countdown. The "beanie cap" collects the oxygen vapors vented from the tip of the external tank during the loading operation This prevents ice from forming on the tank which could break off at liftoff and damage the tiles on the Orbiter

The Remote Manipulator Arm, a 15 m (50-ft) long mechanical arm used to deploy and retrieve Shuttle payloads, arrived at Kennedy April 22 and was taken to the Operations and Checkout Building for assembly and checkout. It was moved to the processing facility on July 21 for installation in the Orbiter's payload bay Electrical checks were made first with the arm connected only by cable to the Orbiter The arm was mechanically connected to the Orbiter on July 24 A new End Effector arrived at Kennedy July 13 and was installed on the arm and retested

The Shuttle's external tank was moved out of the checkout cell on June 29 and attached to the twin solid rocket boosters The tank was reported hard down at 3.20 a m June 30 Installation of forward and aft struts began immediately followed by preloading of the attach points Electrical cables between the tank and boosters were hooked up and ordnance installed Covers were then installed over the attach struts.

The OSTA-1 scientific package was transported from the processing facility to the Operations and Checkout Building July 1 and installed in Columbia's cavernous cargo bay The OSTA-1 Interface Verification test was conducted July 18-20 to make certain the Orbiter and payload were properly integrated

The Forward Reaction Control System was moved out of the Hypergolic Maintenance Facility on July 2 and was installed on Columbia The left and right Orbital Maneuvering System pods were delivered on the July 11 and 18 and mated with the Orbiter Parallel with checkout of the OSTA-1 payload, all the Orbiter's flight control systems were tested and functional checks made of the Orbital Maneuvering System and Reaction Control System The Orbiter Integrated Test started on July 24.

This test was an extensive two-day test involving prime flight crew members Joe Engle and Richard Truly and the backup crew of Ken Mattingly and Henry Hartsfield During the test, every system onboard the Orbiter, as well as the OSTA-1 pallet and its experiments and the Remote Manipulator Arm, was powered up and exercised the way it will be expected to operate during the STS-2 mission

The test verified the on-orbit computer software that operates the vehicle in orbit, and made sure that all the various systems onboard the spacecraft and the cargo function together properly

Following the integrated test, preparations began for moving Columbia to the Vehicle Assembly Building for mating with the tank and twin boosters. Explosive charges were scheduled for installation in the Orbiter July 26 The payload bay will be closed out for flight and a final verification made of the fuel cells prior to the move. The Orbiter will then be weighed and the center of gravity calculated

Finally, the Orbiter will be taken off the jacks that support the vehicle in the processing facility and lowered onto its landing gear for the tow over to the Vehicle Assembly Building

The move of Columbia and subsequent mating operations with the external tank will require about five days The physical move from the processing facility to the Vehicle Assembly Building -- a distance of about 274 m (300 yards) -- is expected to require about one hour

Once in the Vehicle Assembly Building, it will take about six hours to install the handling sling to the 98-ton Orbiter It will then spend two days on the transfer aisle floor being re-waterproofed The heat of reentry burns away the protective water-proofing agent baked into the tiles before they are attached to the Orbiter

The mating operation, scheduled to start Aug 7, begins by raising Columbia about 15 centimeters (6 inches) above the floor and then leveling the vehicle, an operation that will take about one hour A landing gear and wheel well inspection will follow, taking another hour to complete After the inspection, tire pressure transducers will be installed requiring another 90 minutes. The Orbiter's landing gear will then be retracted, which will take about two hours.

It will take another 90 minutes to hoist and rotate Columbia from the horizontal to the vertical position. Three hours will be needed to reconfigure the sling for the hoist and mate operation. The Orbiter will be lifted vertically 58 m (190 feet) above the floor of the transfer aisle so that it clears the transverse beam separating the transfer aisle from the assembly bays. Then it will be swung over the large beam and gently lowered to just above the deck of the launcher platform in the assembly bay for mating with the tank. This part of the move will require approximately two hours

External tank/Orbiter mating operations will follow, requiring about 12 hours. On the completion of mechanical mate, the handling sling will be removed, taking about five hours Mating of the tank/Orbiter umbilicals will require 24 hours

The Space Shuttle is scheduled to spend less than three weeks in the Vehicle Assembly Building The major test conducted with the Shuttle during this time is the Shuttle Interface Test. It is scheduled to begin Aug 12, or about five days after the Orbiter is completely mated to the external tank. This interface test is an extensive checkout of all the flight elements -- the Orbiter, external tank and twin boosters -- to make sure they have been properly integrated

The current schedule calls for the rollout of the assembled Space Shuttle to Pad A at Launch Complex 39 on Aug 26

An extensive four-day series of checks -- the Shuttle Launch Pad Validation -- will follow its transport to the pad This test will verify the Shuttle is properly hooked to pad systems which provide power, propellants, gases, communications and data gathering support required to check out and launch the vehicle

A dress rehearsal of the STS-2 countdown with prime crewmen Engle and Truly in the cockpit of Columbia will be conducted on Sept. 2-3 This test is called the Dry Countdown Demonstration Test It involves the flight crew and Kennedy launch team The test duplicates as closely as possible all launch day events, including a mock countdown and liftoff No propellants are loaded into the Shuttle's external tank The astronauts simulate their launch day activities during this test, including the traditional launch day breakfast, suit up and ride to the launch pad in the Astronaut Van The test helps to establish a timeline for astronaut activities on launch day

At the completion of the dry test CDDT, an Integrated Cryogenic Loading and Auziliary Power Unit recertification test will be conducted For this test, the supercold liquid hydrogen and liquid oxygen will be loaded into the external tank the same way the propellants are put in the tank on launch day The test will continue through a terminal countdown to a simulated T-0, at which Auxiliary Power Unit No 2 will be "hot fired" to verify it operates properly. Only this unit is being tested because it is the only one that was replaced after the STS-1 mission

If all events go as planned, the countdown preparations will begin on Sept. 18 The Shuttle Launch Countdown will pick up on Sept 26 and launch of the Space Shuttle with astronauts Engle and Truly for a five-day mission would occur on Sept. 30

THE STS-2 MISSION -- A PRELIMINARY SKETCH

The plans for the STS-2 mission are virtually complete but are still susceptible to change until the flight plan has been finalized

Current plans call for the launch of STS-2 from the Kennedy Space Center no earlier than Sept. 30 The first window for that date opens at 8 a m. EDT and closes at 11 53 a m EDT.

A second and shorter window opens at 12 18 p.m. EDT and extends for one hour, 38 minutes, to 1:56 p m. EDT

The nominal mission length is 124 hours, 55 minutes (5 days, 4 hours, 55 minutes) There will be 83 orbits of the Earth with the landing taking place on the 84th orbit at Dryden Flight Research Center, Edwards AFB, Calif , at 12.55 p m EDT on Oct 5

Following the shutdown of the Orbiter's main engines and jettison of the external tank just under nine minutes after liftoff, a series of five Orbital Maneuvering System burns will be performed to place Columbia in a circular 252 kilometer (137 nautical mile) orbit inclined 38 degrees to the equator

Prime crew members are Joe Engle, commander, and Richard Truly, pilot. Back up crew members are Kenneth Mattingly and Henry Hartsfield

Full details of the STS-2 flight will be contained in the mission press kit which will be released in September.

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